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## PREFRONTAL CORTEX AND DEVELOPMENTAL PSYCHOLOGY: STRATEGIES THAT WORK FOR IMPROVING COGNITIVE CONTROL AND SELF-REGULATION IN YOUNG CHILDREN

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Executive function (EF) skills are critical for success in school and life. Many children begin school lacking needed EF skills, especially lower-income children.

Educational practices that improve EFs lead to better academic outcomes and may head off mental health problems (such as ADHD) from developing. Many issues are not simply education issues or health issues; they are both.

EFs are, of course, brain-based, but they are not immutable. Evidence will be presented that they can be improved even in children as young 4–5 years of age, in regular public-school classrooms, with regular teachers, without specialists or special equipment. Many interventions address fixing problems after they have arisen; working with young children to prevent problems from arising may lead to far better outcomes at much less expense.

For example, an innovative Vygotsky-based early education program *Tools of the Mind*, improves EFs by (a) embedding supports for, training in, and challenges to, EF in all school activities and (c) emphasizing social pretend play (remember what you planned and follow through, hold in mind your role and those of others, inhibit acting out of character, and flexibly adjust as your friends take the play scenario in unanticipated directions). Social pretend play thus exercises all three core EFs (working memory, inhibitory control, and cognitive flexibility).

Research shows that activities that often get squeezed out of school curricula, including the arts and physical exercise, are excellent for developing EFs and thus can be critical for academic success and for success later in life. Schools are also under pressure to cut back on time allowed for play to provide more time for academic instruction. However, children in *Tools of the Mind* classrooms spend more time on play and yet perform better on academic outcome measures than comparison children who spend more time in direct academic instruction.

## THE DEVELOPMENT OF INDIVIDUAL DIFFERENCE IN MEDIAL FRONTAL CORTEX AND SELF-REGULATION: ELECTROPHYSIOLOGICAL MARKERS

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The medial frontal cortex (MFC) is recognized as central for self-regulatory processes both in adults and children. Such self-regulation includes important aspects of executive functions that are critical both for school readiness, and for emotional and cognitive control throughout development. There has been an emphasis in the literature on cognitive information-processing aspects of the MFC and the anterior cingulate especially, with much reference to the notion of «conflict monitoring» but there are other ways to conceptualize the function of both MFC and anterior cingulate.

There are two aspects of individual differences in MFC that will be the focus of this presentation. The first is that there are major maturational changes in the MFC, reflecting network growth associated with this region. This maturation parallels (and we presume underlies) children's increasing ability to monitor both their environment and their own behaviour as they grow. This maturation is basic to the development of executive functions, especially those relating to the social and emotional self-regulation that is so important for successful performance at school. The second is that the monitoring function of the MFC also differs across people independent of their developmental stage. How people monitor their performance underlies important aspects of personality or cognitive style, such as how one reacts to risks, to successes, or to failures.

These two aspects, maturation and personality differences, come together in the study of adolescent risk-taking behaviours. Older adolescents are more likely to take risks than are younger children, but some are more prone to risk-taking behaviours than others. In addition, the social context may influence the activation of the associated neural circuits. In this talk, I will present models and electrophysiological data that pertain to these sources of individual differences in self-regulation and to networks of the MFC.